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the case of Ghana

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ITS AS A TOOL FOR CITIZENS IN DEVELOPING COUNTRIES; THE CASE OF GHANA

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Abstract

Invariably, ITS has materialized as a universal solution to address problems of traffic congestion, safety, increased energy consumption and air pollution (CO₂) facing citizens of developing countries, such as Ghana. Technically, building efficient and effective ITS requires considerable state-of-the-art urban planning and organized-and-sustainable financial resources. Although, developing countries countenance substantial financial constraints, they require ITS user services, which are cost effective, efficient and compatible with the pace of their development agenda, in order to improve the economic status and living standards of the citizens of these countries. This paper intends to investigate the potentials and applications of ITS as a tool for stirring the socio-economic growth of citizens in developing countries, with emphasis on Ghana as case study. The paper will examine how ITS can be used as a tool to improve the living standards of the citizens of the developing countries as well as citizens in Ghana. The main methodology used to collect data was empirical studies through interviews, surveys and discussions. The paper is concluded with how ITS Technologies have defused and adapted by the citizens of Ghana. The successes chopped and the failures experienced have also been outlined for public good.

INTRODUCTION

ITS EXPLAINED

The term ITS refers to “Intelligent Transportation Systems”. Briefly, ITS is an umbrella term that covers the application of a wide variety of Computers, Communication Systems, Global Positioning Systems (GPS), Satellites, Sensing, Control,

and other information-related technologies to improve the efficiency, safety, and environmental aspects of surface transportation. Major categories of ITS include traffic-management systems, i.e., adaptive traffic signals, automatic incident detection, electronic toll collection, and emission sensing and traveler information systems, e.g., pre-trip planning, motorist information, and dynamic route guidance (1).

ITS is about those systems utilizing synergistic technologies and systems engineering concepts to develop and improve transportation systems of all kinds, to address economic constraints and road transport challenges facing the citizens of developing countries, particularly the citizens of Ghana. These challenges include: protection against road safety (lives and properties), mobility improvement, reduction in travel time and vehicle operating cost, accidents management, congestion control & management, air pollution (CO₂ gas emission), increased efficiency and road safety standards (20).

ITS is the application of Information and Communication Technologies (ICT) to surface traffic and transportation systems. It is designed and built on the conceptual framework of Actor Network Theory (ANT) approach as its theoretical framework, which maps relationships between human (people, users, organizations, etc.) and material things (nonhuman, e.g., objects, structures, etc.), which are called “Actors” (4, 5, 7).

Fig. 1 Diagrammatical Illustration of ANT



Fig.1 above illustrates diagrammatically the link or relationship between these Actors or Elements that traditionally customize the design of ITS Technologies. These Actors are composed of: People, i.e., Human Institutions; Roads (nonhuman), i.e., Transport Infrastructures and Vehicles (nonhuman), i.e., the Objects. These three Actors or Elements are associated or linked by Telecommunications Technology, integrated with IT Networks (Computers, Servers, Routers, Switches, Etc.). The key goal of ITS is to build integrated systems for People, Roads and Vehicles (See Fig. 1) in order to resolve problems of road transportation, including traffic congestion, traffic accidents and environmental damages. For the purpose of this paper, “People” here, refers to the citizens of developing countries, e.g., Bulgaria, South Africa, Philippines, Brazil, Ghana, etc., (32).

ITS deployment

Vehicle information & communications system: A comprehensive data is gathered from Road Transport Infrastructures through Vehicle Information & Communications System (VICS) (3). The data is inputted and processed in the VICS Center which is then transmitted to roadside beacons using FM multi-channel broadcasting. VICS on-board unit or navigation system then displays information on the location, activities, status and the current traffic volume along roads that the driver will traverse, providing road traffic information in real time, realizing smooth traffic and higher travel speed, resulting in the improvement of actual fuel efficiency. The notable effect of VICS is the reduction in CO₂ emissions which is about 240 Mt by 2010.

Electronic toll collection systems (ETC): ETC uses electronic means of collecting toll fees which makes transaction faster than the manual payment scheme or E-pass. The vehicle need not stop at gates because a roadside antenna reads the on-board ETC card and automatically collects toll fee from prepaid debit-credit card.

ITS AS A Tool

In the past few years, tools have been developed based on different communication means with the purpose of achieving a safer, more efficient, and environment-friendly operation of vehicular flows in the transport systems. Some of the early means generally involved a very strong human participation. In the course of time and with the rapid progress made in electronics, telecommunications, and computer systems, such processes have become automated to the extent of generating a series of technologies that currently are incorporated into the single generic term of intelligent transportation systems (ITS) (6). The term “ITS as a Tool”, refers to the ability of Intelligent Transport Systems to apply Information and Communications Technologies (ICT) to transport infrastructures. It is the integrated use of Telecommunications and Informatics, for application in vehicles and with control of vehicles on the move. This includes the use of, but not limited to: GSM, Global Positioning System (GPS), Wireless and Satellite Communications systems and many more (8, 9, 10, 11, 12).

Benefit of ITS as a tool

ITS, as a tool, can facilitate, the delivery of a wide range of policy objectives by governments of developing countries for their citizens and for public good at large. For good policies and good governance, there are at least six main objectives or benefits identified in the international literature. These include: Safety, Mobility, Efficiency, Productivity, Environment and Customer Satisfaction (13, 29).

IMPORTANCE OF ROAD TRANSPORT IN NATIONAL ECONOMIC DEVELOPMENT

Mobility is extremely important to the overall societal way of life and the economy of every nation. It is a basic right, and the transportation of people and various consignments is an essential element supporting people's lives. Since regional and international trade creates interdependency between nations, it is essential to make sure that the transportation needs for people and goods are effectively and adequately met. In many parts of the world, freight transport is shifting from rail to road, making it increasingly important and motivating to make road transport efficient and safe to use and to eliminate any negative effects.

E.g., surface haulage is an essential component of any country's economic activities, and forms an integral part of businesses, resulting in socio-economic development and improvement in the living standards of people. In Ghana particularly, as businesses are increasingly influenced by the dynamics of internal and external trade & investments, the need and demand for domestic and regional road transport operations and services are mounting dramatically.

ITS – A TOOL FOR CITIZENS OF DEVELOPING COUNTRIES

Without doubt, citizens in developing countries, who countenance extensive economic and financial constraints, necessarily need ITS technologies that are proficient, cost effective, and attuned with the level of their economic development agenda. Although, ITS technologies are being developed and deployed in many parts of the developed world many years now, and is positively contributing to road safety, protecting the environments, dwindling transportation cost and alleviating congestion, etc., institutional and political leaders in the developing countries are not doing much to use the potentials of ITS technologies as a tool to improve their national economies, by developing and deploying these ubiquitous technologies and applications for public good and in the best interest of the citizens in their countries (15, 16).

HOW ITS CAN ASSIST AS A TOOL FOR CITIZENS OF DEVELOPING COUNTRIES

By and large, ITS represents a new collection of approaches for addressing the problems of road transportation systems facing citizens in developed nations, e.g., Europe, USA, Japan, Singapore, etc., (32). Similarly, ITS can facilitate the enhancement of mobility by providing citizens in developing countries, e.g., Bulgaria, South Africa, Philippines, Brazil, Ghana, etc., to mention a few with better information on travel choices, times and routes, both before and during trips. ITS can aid enhanced mobility by making public transport a more attractive and reliable choice in these countries. ITS provides a variety of tools for improving cargo handling and truck logistics, including mechanisms for identifying and tracking goods in transit and for tracking and communicating with truck fleets (1). Citizens of developing countries can help themselves by applying the inherent potentials of ITS, as a tool, to: mitigate against congestion by encouraging the use of public transport, by leveling loads on road facilities through dynamic routing, by helping to prevent traffic accidents, clear incidents and return driving conditions to normal more rapidly; reduce crashes and fatalities, etc.

SOME DEVELOPING COUNTRIES IN WHICH ITS IS BEING USED AS A TOOL FOR THE CITIZENS

For the purpose of this paper, a few countries are sampled randomly by way of citing examples of developing countries where ITS is being used as a tool for the citizens.

ITS as a tool for citizens of Bulgaria

The Bulgarian Ministry of Transport, Information Technology & Communications emphasized in 2008 that ITS plays a major role in the development of every modern society as a means for economic development and a prerequisite for achieving social and regional cohesion (18). The transport sector of Bulgaria is of an exceptional importance for raising the competitiveness of national economy and for providing services to its citizens. The fact that the Bulgarian transport system supports, on a daily basis, an average of 2.54 million passenger trips and 274,000 tons of freight, is an indicative example of the importance of ITS for the citizens of Bulgaria.

Transport and communications generate 11.7% of the gross value added in the country and directly employ more than 138,000 persons. Strategy for the development of the transport system of the Republic of Bulgaria states that, by 2020, Bulgaria should have a modern, safe and reliable transport system in order to satisfy the demand for high-quality transport services and to provide better opportunities for its citizens and business (*Source: National Statistical Institute – NSI, Employees under labour contract*).

Data about passengers carried (thousand/year) shows that road transport performance (million passengers-km) for 2003 – 2008 was very impressive as presented in the table and chart below.

Transport modes	Passengers carried – thousand					
	2003	2004	2005	2006	2007	2008*
Railway transport	35 206	34 149	33 748	34 113	33 283	33 759
Road transport	795 066	685 233	664 266	623 249	594 879	589 786
Maritime transport	6	3	6	5	11	7
Inland waterway transport	73	81	80	75	232	246
Air transport	1 471	1 782	2 071	2 320	2 237	2 636
Urban electrical transport	329 444	299 850	288 410	286 339	293 794	299 100
Total	1 161 266	1 021 098	988 581	946 101	924 436	925 534

Table 1 Passengers Carried 2003-2008

Source: National Statistical Institute (NSI) Note: The Data for 2008 is preliminary (Statistical Reference book 2009) Note: The Data for 2008 is Preliminary (Statistical Reference Book 2009).

A Histogram showing Transport performance, million passengers-km, 2003 – 2008

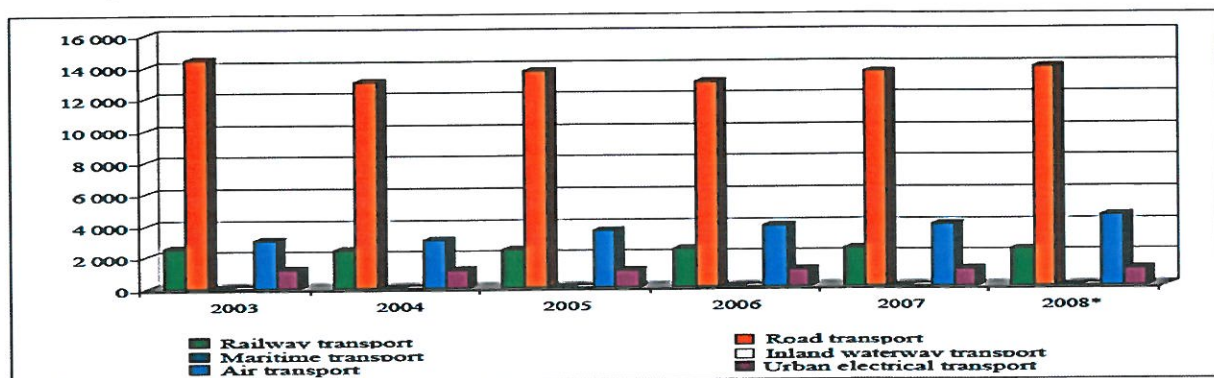


Fig. 2 Transport Performance, Million Passengers-Km, 2003 – 2008

Source: National Statistical Institute (NSI) Note: The data for 2008 is Preliminary (Statistical Reference Book 2009). The Histogram shows that, the road transport sector performed very well.

ITS as a tool for citizens of South Africa

The Government of South Africa has declared to its citizens “The right to movement is a fundamental right. The choice of movement is also a fundamental right. Therefore the right of citizens to reliable and safe public transport cannot be compromised. The commuter is the most important person and mutual respect is of paramount importance” (19). The declaration emphasized that, as government, it has a mandate to ensure safe, efficient and affordable public transport for citizens. The Integrated Rapid Public Transport Networks (IRPTNs) developed during the 2010 World Cup are accelerating improvements in public transport in South Africa.

South Africa's public transport strategy, which comprises a multi-billion Rand transport infrastructure plan, is set to entirely reshape public transport travel in South Africa for the good of its citizens. For these purposes, and in the best interest of the citizens, South Africa has invested heavily in her road transport infrastructure upgrades in the past few years and ITSs form part of the transport network. South Africa is fast on its way to becoming the first country in Africa to have rapid public transport networks. It is going to change the face of this country and will create more opportunities for work and tourism.

ITS as a tool for citizens of Philippines

Transport infrastructure plays an important role in integrating the island economies of an archipelago such as the Philippines (31). The citizens of Philippines rely heavily on the country's road network to handle most of the passenger movement, and about half of freight movement. Airport and rail infrastructure provide alternative means of transporting people and goods to major economic hubs around the country. However, important challenges remain with serious consequences for the country's competitiveness and for meeting its growth and poverty reduction targets. Although the road network is quite extensive, less than half is considered to be in good condition; roads leading to many tourist destinations and in conflict-affected areas in Mindanao are inadequate and road congestion has become a major problem in highly urbanized Metro Manila. Both inter-city and intra-urban region transportation and communications systems are often inadequate.

ITS as a tool for citizens of Brazil

Many years ago, Brazil had challenges developing its transportation system for the benefit of her citizens (33). This was as a result of lack of ITS as tool for development of the transport sector of her national economy. The country had problems transporting her citizens and goods to the major industrial centers. Most of the goods and people were transported by canoes on the river systems; by use of mules and by foot. As the coffee industry became important, railroads were built to facilitate trade by helping the export coffee. However, they did very little to enhance the communication and connection between the remote areas of Brazil and the major industrial centers. Today, land transportation has become more effective, in that, about 85% of Brazil's citizens and products are transported by road. Brazilian highways are of modern design and link all the state capitals by paved roads. Transportation in Brazil has improved over the last three decades, but more roads and railways are needed to enable economic development and for the rural poor to access better facilities and jobs, because, they deserve this as citizens (34).

Brazil will host the FIFA World Cup Soccer tournament in 2014 and the Olympic Games in 2016 (the first Olympics to be held in South America), symbolic of Brazil's global standing and economic emergence. For the 2014 World Cup, \$15 billion will be spent in Brazil (the largest proportion of which in the state of São Paulo) to upgrade transportation systems with ITS applications and related infrastructures. The 2016 Olympics in Rio de Janeiro are expected to require an additional \$14 billion of investment, with the majority dedicated to urban transport, an urgent need for the city, the citizens and foreign nationals who will be in Brazil before, during and after these international events.

ITS AS A TOOL FOR CITIZENS – THE CASE OF GHANA

ROAD TRANSPORT HAULAGE TRACKING PROBLEMS IN GHANA

National economic commodities and products like: petroleum, agricultural, mineral, etc., are surface-hauled for export, import or distribution on daily basis to run the national economy. Geographically, Ghana lies on the West coast of Africa, hence inland countries around her depend heavily on her two sea ports, for the haulage of their imported and exporting goods. The transiting-haulage operations by neighbouring countries earn Ghana some significant foreign exchange which is urgently needed to turn the national economy around. However, there are substantial inefficiencies in the Road Transport Haulage Tracking Industry in Ghana. These inefficiencies include, but not limited to: Lack of modern road transport haulage tracking systems; In-effective communication between freight owners, operators and drivers due to lack of modern ICT (21); Diversion of routes and commodities due to misconducts of drivers and mates; Un-due delays of destination and transiting consignments; Inappropriate use of haulage resources by drivers and other personnel; and, most importantly, Lost of vital man-hour production time and revenues, e.g., Taxes, Duties and Levies which are much needed to sustain the national economy of Ghana and that of other developing countries.

HOW ITS TECHNOLOGIES ARE BEING DEFUSED AND ADAPTED IN GHANA

Without doubt, technology is changing everything around us. Technology even affects how we live our lives, communicate, drive and even manage our financial affairs. It is only fair for all citizens to expect that technology will have a significant impact on both road safety and on how much we pay to travel our roads (32). One set of typical technologies that comes to mind in this regard, is the set of ITS technologies. In this regard, one key aspect of ITS Technologies that has been defused and adapted by the Ghanaian citizens is in the area of Intelligent Vehicle Tracking Technology (IVTT) - a core constituent of ITS technologies, developed and deployed into the road transport haulage tracking industry, purposely to unravel the problems of operational inefficiencies enumerated above (17).

Who are the stakeholders in the road transport haulage tracking industry in Ghana?

The major players and stakeholders in the road transport haulage industry include: Bulk Haulage Carriers and the Ghana shippers Council – responsible for carting and implementation of goods and services; Customs Excise & Preventive Services (CEPS) – accountable for monitoring road transport haulage of consignments, and in charge of collecting duties, taxes & levies on behalf of the government; Mobile & Wireless Communication Service Providers, Internet Service Providers, the ICT Industry, Etc., (14, 21, 22 ,23 ,28).

APPLICATIONS OF ITS AS A TOOL FOR ROAD TRANSPORT HAULAGE TRACKING IN GHANA

What is road transport haulage tracking?

Basically, surface tracking is the technique of installing or attaching electronic devices (trackers) to cargo trucks that communicate valuable operational information by transmitting signals, which are gathered by orbiting satellites, through GPS, that returns the signals back to the screen of a remotely computer monitoring systems via vehicular communications networks. It is the process of capturing and monitoring the precise and continuous positions and activities of cargo trucks at a particular time or at all times, to ensure effective and efficient operations and management in the haulage tracking industry. This GPS vehicle tracking system enables truck haulage managers and other stakeholders to monitor the activities of their drivers and vehicles in real time using state-of-the-art satellite mappings, via the Internet.

Benefits of surface haulage tracking to the government and stakeholders in Ghana

The following are few, but not the least benefits derived by the government and stakeholders for undertaking surface haulage tracking in the road transport sector of the national economy: Enabling accurate “real-time” statistics on revenue & foreign trade; Building a Transaction Price Database; Providing systematic monitoring of the movement of consignments from the country’s entry points; Encouraging Compliance and Professionalism and To facilitate trade and promote Ghana as the preferred Gateway to West Africa.

The importance of road transport haulage tracking in Ghana

Haulage tracking systems - a great contribution of technology, has become a blessing in disguise for the various transportation and logistic companies in Ghana, providing easy means to gather valuable operational information relating to their haulage trucks. National economic commodities such as agricultural products (cocoa, timber, fertilizers, etc.); petroleum products from the Ghana’s oil fields; minerals (gold, diamond, bauxite, etc.), etc., are transported across the country. These are done through haulage companies that run their fleet of trucks to transport these products. Managing such a large number of haulage trucks is a more difficult task. However, the availability of haulage tracking system, a subset of IVTT which is a constituent of ITS Technologies ensures easy management and control of such large fleet of haulage trucks.

CURRENT IMPLEMENTATION OF ROAD TRANSPORT HAULAGE TRACKING IN GHANA

Road transport haulage tracking in Ghana is inevitable as a result of the challenges facing government, the business community and the citizens at large, in the areas of national revenue collection activities, profit maximization and road transport safety. The Major Challenges include: Revenue leakages and low profit margins due to diversion of destination and transit goods into the Ghanaian domestic markets;

Cargo Tracking based on manual or physical escort system which is unreliable, costly and out-dated; Criticism from logistics companies and neighbouring countries (e.g., Togo, Benin, Nigeria, etc.) on being an obstacle for regional and international trade in the Sub Saharan Africa; Security problems e.g. smuggling of fire-arms into Ghana and the neighbouring countries, e.g., Togo; Lack of co-ordination, effective scientific monitoring and evaluation of road safety planning, strategies and programmes; Unable to set standards for road safety equipment; Non-existence of research into road safety in Ghana.

Faster transit with GCNet satellite tracking system

To address the above problems, GCNet (a surface haulage tracking organization) introduced a new Satellite Tracking System into its infrastructural setup. The new GCNet setup is as shown below. With the introduction of satellite tracking of transit goods, transit consignments are exiting the country faster than when manual or physical escorts were being used (26, 27).

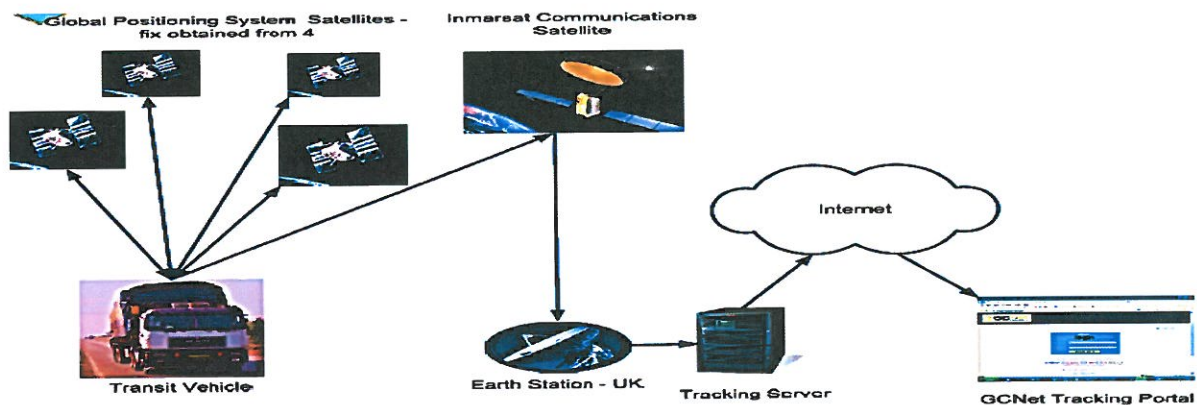


Fig. 3 GCNet Satellite Tracking System. *Source: GCNet PPP*

Function of the GCNet tracking technology

The position and coordinates of the cargo truck is captured by four GPS and relayed to an IMARSAT Communication Satellite, which sends the tracked information to a Satellite Earth Station in the UK. The information is stored in a Tracking Server at the Earth Station. This information is received online via the Internet at the GCNet Tracking Portal terminals installed at the various CEPS entry and departure check points in Ghana (25). The information can always be monitored or retrieved by browsing the internet anytime and anywhere on the globe.

THE SUCCESSES, FAILURES AND LESSONS LEARNT FROM ITS UTILIZATION IN GHANA

THE SUCCESSES

As a result of the deployment of the applications of IVTT into Ghana's surface haulage tracking industry, there has been a commendable surge in revenue generation and collection,

when the GCNet Tracking system was established and implemented by CEPS. With the insertion of the project in 2003, an average annual revenue growth of 33 percent has been recorded from the Tema Harbour and 32 percent from the Kotoka Airport haulage revenue collection points. Between the year 2003 and 2008, the Total Revenue collected by Customs increased by nearly 170 percent (30). There were increases except for the month of July in 2007 when the economy of Ghana faced downwards as a result of astronomical increases in petroleum products. The average revenue per month was over 90 million Ghana Cedis, shown in fig. 3 below. However, this amount realized was woefully inadequate for any meaningful national socio-economic and infrastructural developments, and thus more efforts are needed to improve the system.

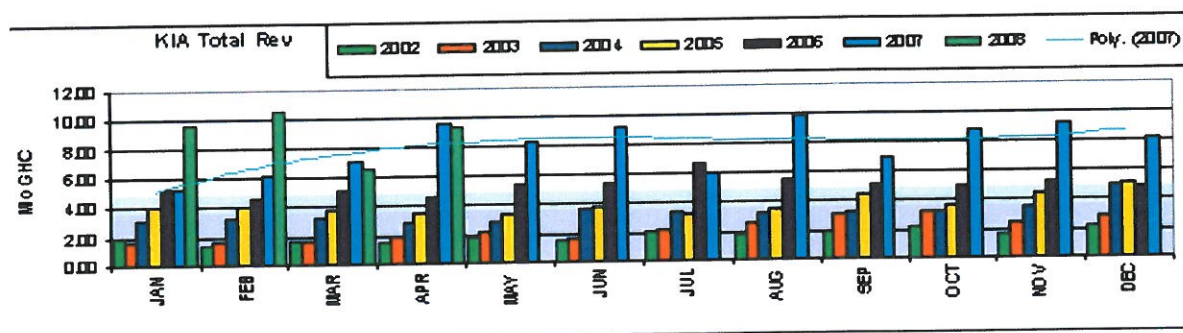


Table 2 Total Revenue Growth for Kotoka International Airport
Source: Ghana CEPS “i-Transit”

THE FAILURES AND DIFFICULTIES

Currently, CEPS has not been able to completely plug considerable revenue leakages which still occur not only on some remote haulage routes, exist and destination check points, but also in urban areas. These menaces do happen through diversion of goods into the local markets due to human attitudes. Some of these incidences also occur as a result of limited coverage of ICT networks (e.g., limited bandwidth, capacity, speed, obsolete computer hardware and software) in both remote and urban areas. On top of these issues, Ghana CEPS receives criticisms from logistics companies and neighbouring countries for being an obstacle for domestic and regional trade due to rigidity and customization of access to ICT applications within the Ghanaian territories. According to the critics, these situations cannot promote ultimate cooperation amount stakeholders. Additionally, Security problems e.g. smuggling of fire-arms into Ghana and the neighbouring countries (National Security), are also threatening and posing challenges to the efficiency of the existing surface haulage tracking technologies deployed in Ghana.

Lesson learnt

From the foregoing studies, one lesson that stands tall is that, active promotion and deployment of IVTT into the Ghanaian surface haulage tracking systems in fulfillment of the Government’s aim of becoming the “Gateway to the West Africa Sub-region” has really caused a huge increase in goods-trading between 2003 and 2008. This has posed significant monitoring and control challenges to CEPS.

CONCLUSIONS

The impressive potentials of ITS can be used as a tool to enhance the socio-economic life styles of the citizens of developing countries, particularly, the people of Ghana, by resolving road traffic problems, such as, increase in productivity levels through road safety; mobility improvement; reduction in fatality rates, average travel time & vehicle operating costs; accidents management, congestion, air pollution, increase in efficiency & road safety standards and improvement in trunk road networks. With the deployment of the GC e-Trak tracking system, the problems of compromised revenue collection due to ineffective control of transit and destination consignments, which lead to their diversion onto domestic markets in Ghana and perhaps in other developing countries without payments of relevant duties and taxes, are relatively reduced, but there is the urgent need for more improvements.

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